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# THE ANCIENT QUIPU, A PERUVIAN KNOT RECORD

By L. LELAND LOCKE

## INTRODUCTORY NOTE

The following article by Mr Locke appears to be a genuine contribution to our knowledge of the quipu, and to make it quite certain that the knotted cords were used simply as numerical records, and not, as is often supposed, for narrative purposes. Mr Locke shows clearly that he is able to read the various authentic specimens, since his interpretation admits of a definite check. It would seem, therefore, that we have here the earliest known decimal notation of the Western World, at any rate the earliest that admitted of easy transportation. The publication of such an article will be of interest to archeologists as well as to those who work in the domain of the history of mathematics. For the latter, the quipu forms a chapter in the extensive history of the abacus, a topic that has never yet been worthily treated but one that Mr Locke is beginning to investigate.

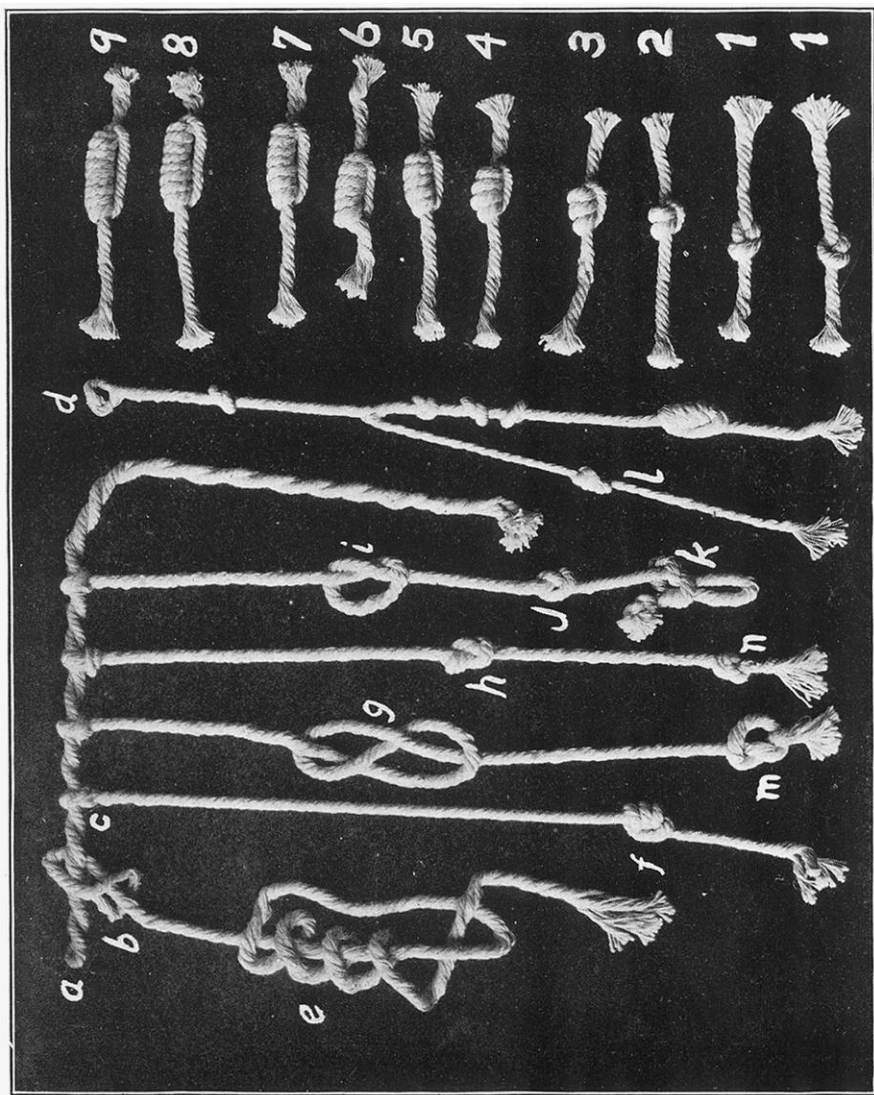
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THE use of knots in cord for the purpose of reckoning and recording number seems to have been as universal as the figures of the cat's cradle<sup>1</sup> in the play life of primitive peoples. Both may be said to be indigenous to all lands in which the arts of spinning, weaving, and dyeing have been cultivated. In two noteworthy cases tradition makes the knotted cord serve as letters. In China<sup>2</sup> knot records are said to have preceded the knowledge of writing.

In more recent times the most remarkable development of knot records took place among the Incas of Peru. Here is found the anomaly of a people with a highly complex civilization, particularly in governmental machinery, with a wealth of tradition, and with a peculiarly rich and expressive language, but with no system of

<sup>1</sup> Jayne, Caroline Furness, *String Figures*, New York, 1906.

<sup>2</sup> Carus, *Tao-Teh-King*, English edition, p. 137; Gouquet, *De l'Origine des Loix*, etc., 1758, vol. III, pp. 171, 312; De Mailla, *Hist. Gen. de la Chine*, vol. I, p. 4; Martini, *Hist. de la Chine*, vol. I, p. 21; *Jour. Ethn. Soc.*, London, 1870, pp. 5, 13; *Nature*, 1876, vol. II, p. 405.



MODE OF TYING THE KNOTS

*a*, main cord; *e*, knot for the number *three*; *loose*; *f*, the same, *taut*; *g*, *h*, *i*, *j*, knots for *one*.

writing,<sup>1</sup> either hieroglyphic or phonetic. A very important question concerning the culture of the Incas is to determine to what extent knot records took the place of writing. Nearly all writers on Peruvian history and archeology, during and since the Conquest, have detailed, at more or less length, the practice of using knotted strings, or *quipus*,<sup>2</sup> not only for numerical records but for the preservation and transmission of royal orders, orations, poems, traditions, and historical data.<sup>3</sup>

The most reliable information given by one who actually understood<sup>4</sup> and used the quipu is to be found in the works, cited above, of Garcilasso de la Vega. The writer was born at the Inca capital, Cuzco, in 1539. He was the son of a Spanish cavalier of the same name, and his mother was the Inca princess, Chima Ocllo, a niece of the Inca Huayna Ccapac. The young Inca spent the first twenty years of his life among his mother's people, imbibing their culture and traditions.

There are five sources upon which a comparative study of the quipu may be based:

1. A compilation<sup>5</sup> of statements from Spanish sources following the Conquest.

<sup>1</sup> *Commentarios Reales, por el Inca Garcilaso de la Vega*, Madrid, 1723, vol. I, vi, chapters 8-9, pp. 181 et seq. Vol. II is entitled *Historia General del Peru*, Madrid, 1722. References to Vega in this paper are uniformly to this edition. Tradition says that in the reign of Huanacauri Pirua, the third of the old kings of Peru in the list of Montesinos, the use of letters was known and the art of writing on plantain leaves, and that the eighty-first king, Tupac Cauri Pachacuti, prohibited the use of plantain parchment and introduced knotted strings.

<sup>2</sup> The word *quipu* in the so-called Quichua language means "knot", and those in charge of the records were called *quipucamayos*.

<sup>3</sup> Vega, I, chapters 8-9, II, 23, p. 29; Polo de Ondegardo, Corregidor of Cuzco in 1560, *Relaciones*, MS., quoted by Prescott, *Conquest of Peru*, I, p. 123; Cristoval Vaca de Castro, *Discurso*, p. 5, quoted by Bandelier, *Islands of Titicaca*, p. 332.

<sup>4</sup> Yo tratè los Quipus, y ñudos con los Indios de mi Padre, y con otros Curacas, quando por San Juan, y Navidad venian à la Ciudad, à pagar sus tributos. Los Curacas agenos rogavan à mi Madre, que me mandase les cotejase sus Cuentas; porque como gente sospechosa, no se fiavan de los Españoles, que les tratasen Verdad en aquel particular, hasta que yo les certificava della, leiendoles los traslados, que de sus Tributos me traían, y cotejandolos con sus ñudos; y desta manera supe dellos tanto como los Indios.—Vega, I, vi, 9, p. 183.

<sup>5</sup> The writer is completing a bibliography of the quipu and such a compilation. He wishes to express his appreciation for much help and suggestion generously given by Mr A. F. Bandelier.



QUIPU, OR PERUVIAN KNOT-RECORD

The number of pendent cords (95) is indicated by knots on the ends of the main cord. B 8705 American Museum of Natural History. Scale  $\frac{1}{2}$ .

2. Drawings of supposed quipu. Some of these are without question apocryphal, while those that are genuine are drawn with little attention to the details which are necessary to a satisfactory study.

3. Specimens of ancient quipus exhumed from Peruvian graves and now in the collections of various museums.<sup>1</sup>

4. Specimens of present day quipu.<sup>2</sup>

5. A compilation of statements of explorers and ethnologists from the time of the Conquest to the present relative to the continued use of the quipu.

The characteristics of the ancient quipus, both as described by the Spanish writers and exemplified in extant specimens, are:

1. A main cord varying in length from a few centimeters to a meter or more.

2. Attached to the main cord are pendent cords seldom exceeding 0.5 meter in length. These vary in number from one or two to a hundred or more in existing specimens. The manner of forming the cords is to spin a cord of twice the length desired, then double it with a loop at one end as seen in pl. XXI, *b*, and twist the two strands together. Usually a knot is tied at the end of the cord, and in most cases the cord tapers off at the end, indicating the running out of the material in spinning. Both cotton and wool were used, natural white and buff being available in both materials.

The pendent strands are attached to the main cord by passing the free end over the main cord and through the loop formed by doubling and then drawing it taut. See pl. XXI, *b*, *c*. They are variously distributed along the main cord, sometimes with short spaces between the groups, and in other cases placed close together.

3. Knots are tied in the pendent cords at varying distances

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<sup>1</sup> The American Museum of Natural History in New York City possesses a very extensive collection from the Peruvian expedition conducted by Mr. Bandelier during the ten years following 1892. Through the courtesy of Mr. C. W. Mead the writer has been furnished abundant facilities for making a detailed study of this collection.

<sup>2</sup> Cf. Bastian, *Ethnologisches Notizblatt*, 1895. Uhle in *Bulletin of the Free Museum, University of Pennsylvania*, 1897.

from the main cord. These groups of knots are arranged roughly in rows across the quipu. (See pl. xxiv, and compare with Vega, I, vi, 8-9, p. 181 et seq.)

4. In nearly all of the ancient quipu short subsidiary cords are attached to the pendent strands, upon which are indicated numbers that disturb the main count of the quipu.<sup>1</sup> The mode of attaching is seen in pl. xxi, *l*. The subsidiary cord is not found in the specimen discussed in this paper, except that there is an indication of such attaching in cord *b4*, pl. xxiii, where there is a discrepancy in the count of the cord.

5. Character of the knots. Plate xxi shows the forms of the knots and the mode of tying which exist in specimens studied. The single or overhand knot (*i, j*), indicates 1 if it is in the row farthest from the main cord, 10 if it occurs in the next row, 100 in the next row, etc. Not more than nine single knots are found in one group, the number system being strictly decimal.

The long knot, used to express the repetition of units of the same order in place of a cluster of single knots, was likened by Mr Frank H. Cushing to the appearance of the closed fist. (See pl. xxi.) It is formed by tying the overhand knot and passing the end through the loop of the knot as many times as there are units to be denoted. (See pl. xxi, *e, f*.) One end is then drawn taut, thus coiling the other about it the required number of times. There seems to have been no fixed practice as to which end is drawn taut, the upper fixed end, or the lower pendent end. As this would lower or raise the knot on the cord, it is possible that the device was used to keep the knots of one order relatively the same distance from the main cord. The loop has apparently no numerical significance, but from the manner of its appearance on the specimens examined it may have had some such use as the red line used by bookkeepers in closing an account.

<sup>1</sup> Algunos destos hilos tenían otros hilitos delgados del mismo color, como hijuelas, ò excepciones de aquellas reglas generales, como digamos en el hilo de los hombres, ò mugeres de tal edad, que se entendian ser casados, los hilitos significavan el numero de los Viudos, ò Viudas, que de aquella edad avia aquel Año.—Vega, I, vi, 8, p. 181. Cf. Bastian, loc. cit., and Uhle, loc. cit.





The following problems are presented by the Spanish accounts of the quipu:

1. Was the quipu used to record historical events, other than dates and numerical data?

2. Were the knots, mode of tying, grouping, color of cord, twisting of the strand, and distances used to convey ideas?<sup>1</sup> Or were they used merely as *memoria technica*, without any individual significance, as is the case with the beads of the rosary?

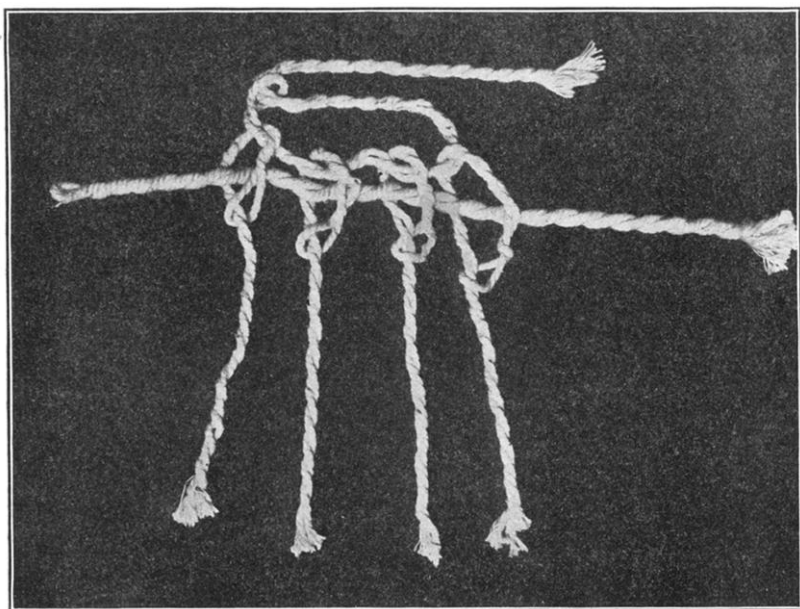


FIG. 45.—Manner of grouping the pendent cords and of attaching the top cord.

3. What was the significance of color? It is well known that there was a system of using roughly suggestive colors, as red for war, yellow for gold, etc.<sup>2</sup>

4. What is the significance of grouping: of distances between the knots and from the main cord; and, finally, of the individual knot?

It is the purpose of this paper to present a study of a represen-

<sup>1</sup> *Tenth Annual Report of the Bureau of Ethnology*, 1888-89, p. 369.

<sup>2</sup> Cf. Bastian, loc. cit., and Uhle, loc. cit., and also Bastian, *Die Culturländer des alten America*, III, p. 74.

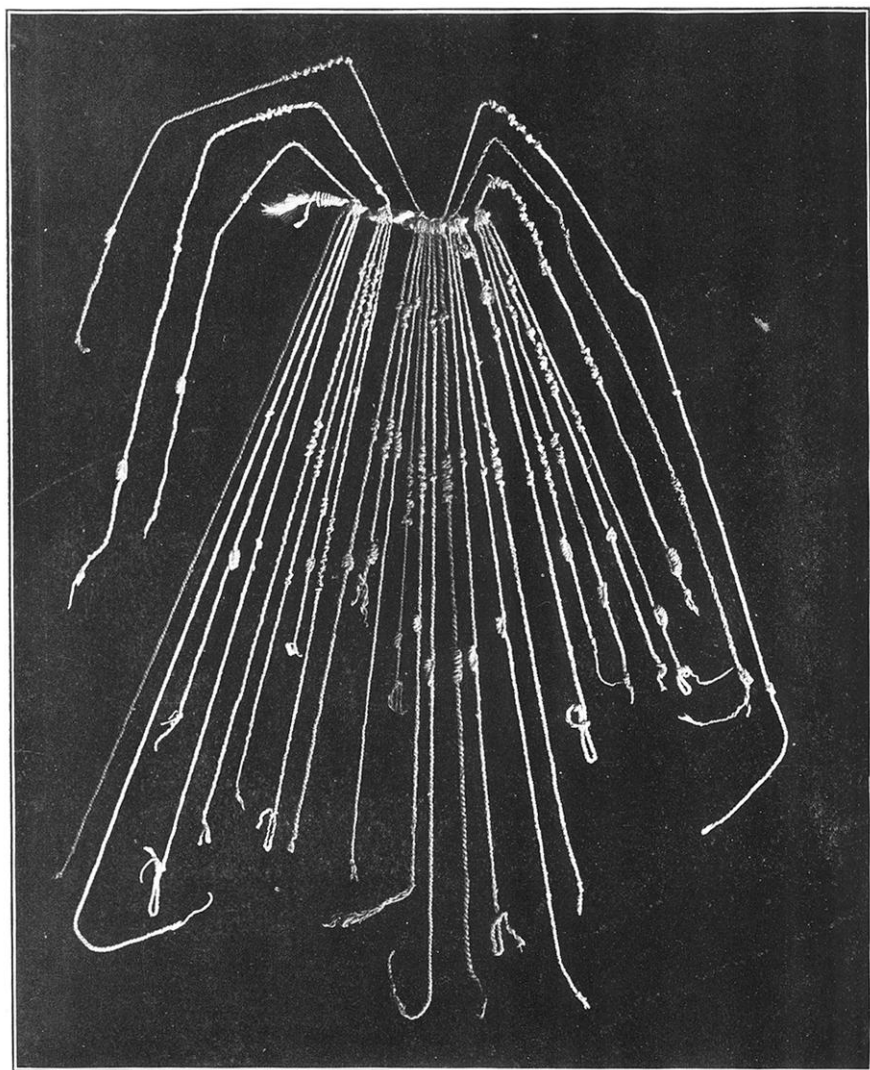
tative specimen to determine what light it may throw on these questions.

The specimen shown in pl. xxiv is No. 8713 of the Bandelier collection in the American Museum of Natural History in New York City, and is one of a number of similar specimens from Huando, on the coast north of Lima. This village was of the Chancay tribe, which was subdued by the Incas some time before the Conquest, and from which tribute was levied. The characteristics of this and the other specimens from this vicinity are: (1) the practice of using the long knot for units only and groups of single knots for the higher orders; (2) the use of the loop on the first (or last) cord of a group; and (3) the pendent cords are grouped by passing a top cord through the top loops of the group as in fig. 45. *The top cord sums the numbers on the pendent cords through which it is looped*, thus giving an accurate key to the numerical character of the knots. Some difficulty was experienced in reading the long knots, owing to the condition of the cord. In the accompanying table is given the first reading, followed by the probable reading in parentheses. Pl. xxiv is from a photograph of the quipu; pl. xxiii is a diagram of the arrangement of the knots, and of their numerical significances.

The following hypothesis may be made in regard to this quipu. It is possibly a record for six periods or years of four kinds of objects.

#### CONCLUSIONS

1. These knots were used purely for numerical purposes.
2. Distances from the main cord were used roughly to locate the orders, which were on a decimal scale.
3. The quipu was not used for counting or calculating but for record keeping. The mode of tying the knots was not adapted to counting, and there was no need of its use for such a purpose, as the Quichua language contained a complete and adequate system of numeration.
4. Other specimens examined contain the same types of knots, there being but ten variations in all, two forms for the single knot and eight long knots. These eight differ from each other and from the single knot only in the number of turns taken in tying. There



AN EXAMPLE OF THE HIGHEST DEVELOPMENT OF THE QUIPU AS A NUMBER RECORD

American Museum of Natural History, B8713. Scale  $\frac{1}{4}$ .

TABLE OF KNOT READINGS AND COLORS

Strands	1000's	100's	10's	1's	Color
Main cord	—	—	—	—	White and dark brown
1	—	—	—	—	Brown
2	—	—	1	—	White
3	—	—	—	6	White
4	—	—	—	1	White
Sum	—	—	1	7	Very light brown
a	—	—	1	7	
1	—	1	5	—	White and reddish brown
2	—	6	4	1	White and light brown
3	—	6	3	6	White and dark brown
4 <sup>1</sup>	—	—	9	—	White and dark brown
Sum	—	13	21	17	White and light brown
b	1	4	1	7	
1	—	1	3	4	Brown
2	—	3	6	5 (6)	Brown
3	—	2	5	—	Brown
4	—	—	6 (5)	5	Brown (darker)
Sum	—	6	19	15	Light brown, reddish
c	—	8	—	5	
1	—	—	8	6 (7)	Blue
2	—	3	1	9	Blue
3	—	1	6	8 (9)	Blue
4	—	—	3	6 (7)	Blue
Sum	—	4	18	32	Light brown, yellowish
d	—	6	1	2	
1	—	—	1	7	Light blue and white
2	—	—	6	—	Light blue and white
3	—	Fragmentary	—	—	Light blue and white
4	—	—	1	1	Light blue and white
e	—	1	3	5	Light brown and dark brown
1	—	—	8	9	Light brown
2	—	2	5	8	Light brown
3	—	2	7	3	Light brown
4	—	—	3	8	Light brown
Sum	—	4	23	28	Light brown
f	—	6	5	8	

is nothing about any specimen examined to give the slightest suggestion that it was used for any other than numerical purposes.

<sup>1</sup> Fragmentary subsidiary cord, attached (?); discrepancy of 100 in count.

It may be that through the irony of fate no historical quipus, if they ever existed, have been preserved.

5. If the hypothesis that this quipu is a record of the same classes of objects for six periods be correct, it would seem to indicate that the colors in this case have no special significance, but were taken according to the fancy or convenience of the maker. This does not signify that there was not a rough color scheme in use for some purposes.

6. These specimens confirm in a remarkable way the accuracy with which Garcilasso described the manners and customs of his people.

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